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Deaf students and problem solving in mathematics

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Deaf Students and Problem Solving in Mathematics

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Deaf Students and Problem Solving in Mathematics

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Abstract

Currently, there exists a gap between findings in the research in mathematics education of deaf students and subsequent changes in educational settings for deaf students. Problem solving skills has become an area of particular concern. Deaf students' performance on problem solving tasks and word problems falls below that of their hearing counterparts. The research into the causes is organized into four broad categories: language and communication, semantic and conceptual understanding or cognition, the effects of educational environment or experience, and testing of proposed strategies. The implications of these research including reading, vocabulary, conceptual understanding, teacher preparation, incorporation of the Standards, technology, problem-solving skills strategies, and cognitive education are discussed as are recommendations for future research. The creation of an on-line resource to provide teachers with easy and fast access to research findings in the field of problem solving for deaf students as well as concrete ways to incorporate these findings in their instructional methods is suggested.

Introduction/Statement of Problem

Purpose

Currently, there exists a gap between findings in the research in mathematics education of deaf students and subsequent changes in educational settings for deaf students. The purpose for creating this on-line resource is to provide teachers with easy and fast access to research findings in the field of problem solving for deaf students as well as concrete ways to incorporate these findings in their instructional methods.

Importance of the Problem

The availability of research findings in a summarized, on-line format will allow all teachers of deaf students easy access to important discoveries in this area as well as ways in which to incorporate the findings into their teaching.

Goals

The main goal is to create an on-line resource for teachers of deaf students related to mathematics problem solving. Research articles in the area of problem solving with deaf students will be summarized and posted to the Internet. Sample lesson plans with concrete examples of how to incorporate the findings of the research will be posted as well.

Order of Presentation

The research into the causes are organized in this literature review into four broad categories: language and communication, semantic and conceptual understanding or cognition, the effects of educational environment or experience, and testing of proposed strategies, and will be discussed in that order. Recommendations for future research and implications follow. Finally, a brief description of the product, an on-line resource, will be given as well as the Clearinghouse On Mathematics, Engineering, Technology and Science (COMETS) Web site, where the project will be posted.

Literature Review

In the field of deaf education, problem solving skills has become an area of particular concern. Deaf students' performance on problem solving tasks and word problems falls below that of their hearing counterparts. Research has been done in this area, but definitive causes for the differences in performance between deaf and hearing students have not been found and there is a delay between findings made in the research and implementation of changes in classrooms based on these findings. The purpose of this literature review is to identify relevant information on mathematics problem solving with deaf students. The studies reviewed will provide the basis for an on-line resource for teachers of the deaf and researchers alike.

The research into the causes can be organized into four broad categories: language and communication, semantic and conceptual understanding or cognition, the effects of educational environment or experience, and testing of proposed strategies. These will be discussed here.

Language and Communication

It is clear that reading and language are key to the educational process, and yet the average 20-year-old deaf high school graduate reads at a third or fourth grade level (Kidd, Madsen, & Lamb, 1993). Deaf students' scores on the Stanford Achievement Test (SAT) show that Word Meaning is the lowest area of performance. Math Ability is comparatively high but still is below norms for hearing children. The greatest difference in scores between deaf and hearing students in math is in Math Applications, which has more language than any other math subtest (Kidd et al., 1993). The research in the area of deaf students and math word problems focuses on the necessary abilities that students must have in order to understand the problem, how word problems differ from spoken English and signed languages, and how to teach students to successfully read and understand word problems. A summary of relevant findings follows.

According to researchers, to solve a verbal math problem, a student must first be able to understand the necessary math processes and applications of the processes, demonstrate accuracy in computation skills, and demonstrate the necessary reading skills to understand the problem (Kidd, 1991; Borron, 1975). Reading skill appears to be a particular barrier for deaf students. Knight & Hargis (1977), for example, suggest that the achievement and difficulty that deaf students have with math word problems relates more to their coping skills with language than math procedures. (See discussion of Mousley & Kelly below.) Knight & Hargis (1977) report the following as basic parts of math language that young students need to succeed with problem solving in math. First, they emphasize the concept of counting and *how many*. This entails an understanding of a one-to-one relationship between a number name and an object. A second element is the understanding of noun phrases. This includes knowledge of determiners in English and an understanding of a one-to-one relationship—between the determiner and an object. Students must approach word problems with ready understanding of the differences between the determiners *the*, *a* and *an*, and *some* as well as how these determiners are paired with one object, an undetermined number of objects, and objects that have or have not been previously referenced. The differences between ordinal and cardinal numbers (which can also indicate order and not just number) are also required to fully understand noun phrases. Prearticles must also be taught. Some examples of prearticles listed are *one of, each one of*, and *every*. Noun phrases can be used as adverbs, making the understanding of noun phrases an even more complex requirement to reading. Third, the syntax of comparative constructions, which are common in math word problems, appears to be important for deaf students' understanding of word problems. Two examples are *an* and *more than* or *–er than*. Both can be used as an adjective or adverb with count or noncount nouns. Other common comparative forms found in math word problems include comparative and superlative comparatives. Approximately 10% of deaf students at age 6 have not yet internalized all the structures discussed thus far (Knight & Hargis, 1977).

Of particular interest to math teachers of deaf students is how the language used in math classrooms differs from the everyday language used by deaf students as well as how the language used in math word problems differs from standard written and spoken English. Kidd (1991) examined the specific difficulties that word problems pose through analysis of five word problems pulled from a textbook used by 25% of residential deaf schools that year, which are considered representative of the problems typically found in other math books. Kidd (1991) found that math problems have significantly more prepositions than normal written English. Prepositions are abstract and pose a difficulty to deaf students in general. There were also more time phrases than in normal written or spoken English for these randomly chosen problems. More nominalizations, nouns that are understood as verbs, than would normally be found in written or spoken English were found. There is also a significantly higher number of propositions, or units of information, which may or may not be understood by the deaf reader; making inferences and solving the problem necessitates understanding of all propositions (Kidd, 1991).

In a later study, Kidd et al. (1993) also emphasized that words with special emphasis are often seen every day but have special meaning in math, so it is possible that students rely too heavily on their general knowledge of the word. In signed languages, there often is only one form of a word and so deaf students might use the English words that have more than one form interchangeably when they see them in print. Deaf students may have little to no exposure to technical vocabulary that is only used in higher level math courses, there may be no sign for the word and it must be fingerspelled instead and therefore could be harder to teach and recall. Also, unfamiliarity with math vocabulary causes low understanding in reading about math concepts in general (Kidd et al., 1993).

Great importance has been placed on the language arts programs for deaf students, but this emphasis should be placed across the curriculum (Kidd, 1991). One of the National Council of Teachers of Mathematics (NCTM) standards is improving the ability to communicate in math, which includes the ability to read, write, and discuss math concepts. Five potential problems for deaf students with reading math were listed by Lamb and are as follows: First, words with more than one meaning such as "square," "geometric figure," or "polynomial" are potential pitfalls. Second are words or phrases with special emphasis in math such as "how many "and "how many more." Third is the technical vocabulary specific to math. These words as well as their meaning may be new to the students and have no concrete referent. An example of this is the word "sine." Fourth, varied forms of a word such as "multiply," "multiplier," "multiplication," and "multiplicand" could be potentially difficult. Finally, abbreviations and symbols may have no logical connection to the meaning of the word and present yet another form for the student to memorize (Kidd et al., 1993). In an attempt to discover which are most problematic, twenty-five deaf students in a state school from the top two ability groups were given a multiple choice test of 50 questions representing the five categories listed by Lamb (1980). The vocabulary on the test came from middle school texts. The categories were words with more than one meaning, symbols, words with special emphasis, varied forms of words, and technical vocabulary. The respective average scores for each were as follows: 58, 53, 42, 39, and 38 (Kidd et al., 1993).

<u>Semantic and Conceptual Understanding</u>

Although one factor that has largely been depicted as the source of problem solving difficulty with deaf students has been literacy skills, more recent research has shown significant differences in semantic and conceptual understanding. Four studies will be discussed here.

The first study was an attempt to substantiate the concern about the abilities of deaf students in mathematics problem solving and encourage future interventions in this area. Luckner (1992) compared the performances of hearing and hearing impaired students on a problem solving task. Participants, 21 hearing-impaired students and a sample of hearing students matched on gender, age, and race, were asked to solve the Tower of Hanoi puzzle, which is a nonverbal task that does not require verbal instructions to complete. The dependent variables were the number of moves that it took each participant to solve the puzzle as well as the amount of time. Hearing students solved the problem with significantly fewer moves and in significantly less time, confirming the concerns toward deaf students problem solving skills.

In the second study, Frostad and Ahlberg (1999) examined the performance of deaf students on Change problems (subtraction problems that have an unknown start, change, or end) where the problems are presented in a pictographic form so as to separate semantic meaning from the written form. Students were given ten tasks on paper showing pictures from the computer screen and asked to retell the story and then give their answer on paper. Afterward, the interviewer asked questions about how they solved the problem. Results show that older students answered questions correctly significantly more times than younger students and that students performed significantly better on problems with an unknown change or end. Analysis of the videotapes show that students interpreted the problems in one of three ways that are listed in an increasingly developed order of understanding: as numbers and procedures, as take-away situations, and as part-part-whole relations. Through the analysis of the videotapes, it was found that many of the correct answers for problems involving unknown start and an unknown end were due to interpreting the problem as a number with a procedure and simply adding the two given numbers and ignoring the relationship present in the problem. Since significant differences were found for the success with problems set up in semantically different ways but presented through pictures, the authors concluded that reading comprehension is only one important factor to focus on in the mathematical education of deaf students (Frostad & Ahlberg, 1999).

In the third study, a problem solving task involving no verbal instructions or answers and where three practice problems were given before data were collected to ensure understanding of the task on the part of all participants, no significant difference was found between the hearing and deaf groups' use of strategies in problem solving or solutions to the problem. Performance scores for a verbal and nonverbal group consisting of 18 children born deaf and 18 hearing children from a private elementary school matched for gender, age, and IQ. However, a similar pattern of results were found for both the hearing and the deaf groups on different types of problems, suggesting that problem solving and language are independent and that both populations use similar strategies to problem solve (Van der Woude, 1968).

The fourth study, by Titus (1995), focused on deaf and hard of hearing students' conceptualization of fractions. Twenty-one deaf and hard of hearing students and 26 hearing students, age 10 to 16 were asked to determine which of two fractions is larger or if they are equal. Deaf students came from placements in residential, self-contained, and mainstreamed classroom placements. In addition, on the final four questions, students were also asked to explain how they knew the answer. Participants could draw a picture, write a sentence, or solve a math problem to demonstrate how they solved the question (Titus, 1995).

Results of Titus's study show that older students significantly outperformed younger students. Hearing students significantly outperformed deaf and hard of hearing students. A significant interaction was found between age and hearing status, namely, an age difference was only found for hearing students. A pattern was found in the errors made by deaf and hard of hearing students, i.e., questions that consisted of fractions with different denominators were judged in relative size based on the size of the whole numbers in each fraction. The most popular strategy used by deaf and hard of hearing students was the Counting Numbers strategy, whereas older hearing students used a range of strategies demonstrating a more mature understanding. Older hearing students rarely used the Counting Numbers strategy (Titus, 1995).

The results of these four studies suggest that deaf and hard of hearing students lag behind the average hearing student in developing the concept of rational number ordering and semantic meaning of word problems, but that both populations use similar strategies to problem solve.

Effects of Educational Environment/Experience

Within the larger population of students, deficits in problem solving skills have been attributed to a lack of specific knowledge in math reasoning skills and a tendency to act impulsively. Although causes for these delays have not been proven, a possibility that has been brought up in research is experiential differences between hearing and deaf students

Earlier research comparing residential, mainstreamed, and inclusion settings focused on social adjustment. Kluwin & Moores (1985) focused on achievement. Specifically, they compared the achievement of integrated students who are placed with the appropriate supports with the achievement of those not integrated. Some factors that affect placement are achievement, communication skills, social adjustment, reading ability, age of onset of deafness, curriculum, teacher training, potential classmates in each setting, and support services.

The participants of the study were 36 mainstreamed students and 44 in self contained students matched on math ability, reading achievement, degree of hearing loss, and social adjustment. Prior achievement and gender were also controlled for. Nonintegrated students were accepted as participants if they were not placed in an integrated classroom for a reason other than math achievement. Those accepted as participants matched their school's criteria for placement in integrated classroom but were not integrated for some other reason instead. This information on students came from student questionnaires, records, Gallaudet's annual survey, interviews with teachers and interpreters, and the Meadow/Kendall Social-Emotional Inventory.

At the first site, an interpreter was provided for the integrated students. The second site was divided into two schools where the nonintegrated students were self-contained in one building and the integrated students were in the other building, integrated for only one or two classes. All students integrated for one or more classes were placed together in a room with a teacher of the deaf, an aide, and an interpreter. At the third site there were again 2 buildings and students were integrated in both buildings.

Findings of this study show that students who were integrated achieved significantly higher than those who were candidates for integration but not integrated. Possible reasons for the higher achievement, according to Kluwin and Moores (1985), are differences in expectations, exposure, teacher training, parental involvement, and support services. Typically, the expectations in the regular classrooms of the integrated child are higher. Students in integrated classrooms have more demanding content and a greater amount of corrected homework and number of problems worked. There are also more subject area specialists in integrated classrooms. In fact, the schools that this study included had no specialty area teachers in the self-contained classrooms. According to prior research (Bodner-Johnson, 1984), parental interest and expectations account for up to a third of the variation in achievement between the two placements. Finally, more attention is given to the integrated student in that the interpreter is like a tutor, and additional help is available in the resource room. Success of a deaf program is judged by the success of the integrated students and therefore extra attention is paid to them rather than the other non-integrated deaf and hard of hearing students in the same school (Kluwin & Moores, 1985).

In another study, Wood, Wood, Kingsmill, French, and Howarth (1984) administered a math computation test to 414 deaf and hard of hearing students from mainstreamed and residential schools. Analysis of school background, gender, and degree of hearing loss yielded significant results. However, these variables covary and account for only 8% of the variation in performance and are therefore weak predictors of achievement. Further analysis proved that hearing loss is the major, though weak, predictor of achievement.

A second analysis of the data was performed to find patterns that are nonlinear. Students with greater hearing losses had a low score significantly below the low scores of other groups, but there was no difference between the groups' high scores. A comparison of the causes of deafness was performed but the results of this cannot be generalized as the sample size was too small. What can be inferred is that residential schools have more students with more complex causes of deafness such as rubella but still have students with high scores comparable to other school settings.

The main finding of this study is that type of educational setting does not correlate with math achievement when degree of hearing loss is controlled. In fact, all the variables examined in this study, degree of hearing loss, gender and type of school account for very little of the variance in math scores. When significant differences were found for students in different types of schools but with equivalent degrees of hearing loss and intelligence, these differences have been accounted for by differences in school experiences and home environments. Math scores vary greatly in the residential schools from this study. While the effects of etiology of deafness remain undetermined, the fact that the high scores for students from residential schools equals that of students at other schools is a credit to the residential schools since more students with more challenging causes of deafness attend residential schools (Wood et al., 1984).

Strategies Tested in the Research

Since the publication of the three Standards documents by the NCTM, methods and strategies based on the Standards have become the ideal. The Standards, which promote the use of active learning, application of learning in real-life situations, the use of technology for enhancing learned material, integration of learning with other subjects…are dissimilar to the traditional methods of teaching.

The research on the implementation of the Standards shows that there is much support for the Standards and that awareness is increasing within the general population teachers, but that traditional methods persist as well, such as memorization, drill and practice, the use of worksheets and the use of technology for drill and practice. Research examining the impact of implementing the Standards in classrooms has found positive impacts on students' achievement (Pagliaro, 1998).

In deaf education, little research has been done, and what has been done is out of date. In light of the recent reform movement to bring schools up to date with the Standards, this study was designed to answer the following questions: to what extent do teacher and administrators reflect the math reform in deaf education? In what ways is the education in the school structured to promote reform? The authors designed their study from the theoretical standpoint of quantitative theory.

Pagliaro (1998) sent 95 Program questionnaires to schools found using the American Annals of the Deaf, which were filled out by an administrator. Teacher questionnaires were sent to 259 teachers at those schools to be filled out by the teacher in each grade category (K-4, 5-8, 9-12) who best represented the school's program.

Two questionnaires, the Program Questionnaire and the Teacher Questionnaire, were used. Both related to curriculum, instructional materials, and administrative support. Descriptive statistics and summaries of the correlations were made through analysis of the questionnaires. The results are as follows: Familiarity with the Standards increased with grade level. Knowledge of the Standards came, for at least half, from professional conferences or journals. Time spent planning for math classes also increases with grade level, but this may be due to the fact that teachers at higher grade levels are more aware of the Standards and are also responsible for only math classes. Related to instruction, the general trend is toward more reform-like methods; teachers in the lower grade levels show more reform-like methods. While almost 90% of teachers reported using technology in the form of computers or calculators in the classroom, mostly this was for drill and practice. Reports of adequacy and availability concerns over computers were a common theme among teachers. Manipulatives, which are recommended by the Standards, were used primarily in the lower grades and when they are used in higher grades, this is mostly by the teacher as a demonstration. Teachers reported less input and influence on policy in math programs than administrators across all areas except determining schedules (Pagliaro, 1998).

The results indicate that while teachers in deaf education are incorporating more reform-like methods in their teaching, traditional methods are still used, especially in the higher grade levels, and increased reform is needed (Pagliaro, 1998).

Mousley and Kelly (1998) implemented three problem solving strategies in three math classes. The students in the group with the implementation of the first strategy were required to explain the goals and the rules of the problem to a peer observer before starting the problem and then the student and the observer were asked to explain the strategies that were used after completion of the problem. Contrary to the hypothesis stated above, reading level does not correlate with performance; it does however correlate with articulation of strategy. A 2 by 4 analysis of variance showed significance between high-level readers and proficient written explanations.

Students tended to fixate on the recitation of rules and did not seem to internalize them. They also fixated on making moves quickly because of the timed aspect and therefore acted impulsively. In light of this, the students in the second experimental group were required to visualize their moves for 2 minutes before proceeding with solving the problem. The goal of the strategy was to decrease impulsive moves and thus increase achievement. Results show that the experimental group did have significantly fewer moves than the control group.

It is still the case, however, as with the first experimental group, that articulation of the strategy at the end of the problem was poor, sometimes even when the problem was correctly solved.

The third strategy involved the experimental group attending an extra class where the teacher modeled the process of solving a sample problem: This included thinking out loud with voice and sign. The teacher demonstrated identification of all the information and consideration of all the data. Before the class was split into and experimental and control group, a pretest problem was given, the results of which were later analyzed with a 2 by 2 contingency table which showed no significant difference in achievement between the two groups. The participants in the experimental groups showed significant increase in attending to all the information and in the later explanation of strategy for the two subsequent problems given. There was a trend for the experimental group and not the control group for identification of all relevant data, but the trend found did not have significance when analyzed (Mousley & Kelly, 1998).

Results

Recommendations for Future Research

In general, continued research into mathematics education in deaf education that is more frequent and also goes into more detail than the current studies would benefit the field of deaf education. Prior research on hearing students should be tested and adapted for use with deaf students. Analysis of current teaching methods for their effectiveness with deaf students is also recommended.

More specifically, research on word problems where the students are required to represent the problem in picture form before proceeding to find where problems in semantic understanding of word problems could be done. The inconsistency Van der Woude (1968) found between process of solving a problem and the final answer for both hearing and deaf suggests that there is a gap that needs to be explored in future research between the problem solving process and the final solution reached by the participants.

The use of strategies as simple as visualization to encourage students to think before attempting to solve problems, demonstrating strategizing including voicing or signing out loud, using peer observers, requiring written explanations of strategy, and requiring the use of more than one strategy are all recommended based on the research by Mousley and Kelly (1998).

Wood et al. (1984) suggests further study in the area of the differences between school environments of the same type while ensuring that testing in math be done with as few linguistic demands on the participant as is possible. Research is needed in the area of determining the effects that causes of deafness have on performance as well as the interaction of causes of deafness with other variables such as gender, family background, and intelligence. Research examining a possible interaction between degree of hearing loss and variables such as intelligence, cause of deafness, and learning disabilities in that the impact of one of these variables is inflated on students with greater degrees of deafness is also recommended.

Finally, more reviews of research need to be done and made accessible to teachers of deaf students so that the findings of research are more speedily incorporated into the classroom.

Implications

The implications of these research studies span reading, vocabulary, conceptual understanding, teacher preparation, incorporation of the Standards, technology, problem-solving skills strategies, and cognitive education. Math and English teachers could collaborate in different ways so that emphasis is placed on reading comprehension and language arts in math classes, such as with a math journal. An example of a journal entry, as suggested by Kidd et al. (1993) is to describe how to multiply. Learning logs, cooperative learning, and small groups are also suggested. Of great importance are exposure to language models and a good language arts program. Children's literature should be used as well as games that use language and math (Knight & Hargis, 1977). Math books should be chosen based on the reading ability of the students.

Because of the differences between language used in a math classroom and the everyday language used by deaf students and the differences between the language used in math word problems and that of standard written and spoken English, the language of math should be formally taught as well as the computation and math processes. Students should be required to practice communicating mathematically—through writing, signing, or in another visual form.

Vocabulary should be taught and used in context without becoming a focus of the class. All forms of vocabulary comprehension should be taught, namely the written, symbol, examples, conceptually based activities proper sign, and correct fingerspelling (Kidd et al., 1993). Conceptually based signs should be used and invention of signs for classroom use should be done only through careful discussion with sign experts and experienced math teachers.

Conceptual understanding, reasoning ability, and the ability to communicate in math should be priorities in the math classroom as well (Titus, 1995). Based on the results of Ahlberg's study (1999), pictographic word problems can be used to help teach conceptual understanding and avoid semantic misinterpretations. Students can be encouraged to process information at a deeper level through questioning: "How did you know that?" "How would you explain it to…?" (Titus, 1995). Expectations should be raised, and more demanding content should be taught as well as assigned for homework (Pagliaro, 1998).

More than one mode of presentation should be used for concepts. These modes include but are not limited to manipulatives, verbal, pictorial, and symbolic. In connection with this, teachers should ensure that students are able to translate between sign language, English and the language of mathematics and make connections between all the modes presented in all three languages

(Titus, 1995). Adding new connections will also help students to process concepts at a deeper level as well as make retrieval of the information easier.

Technology needs to be made accessible in the classroom and used for enhancing the learning process (Pagliaro, 1998). Real life experiences and activities in the classroom such as comparing the size of objects can be used with students having difficulties with the comparative forms in reading (Knight & Hargis, 1977). In this way, students can make connections between their background experiences and word problems in class.

Problem solving skills should be taught formally and generalizations outside the classroom should also be encouraged. Students can be taught to use more than one strategy when faced with a problem. Practice effects found with both groups suggest that the problems used in Van der Woude's (1968) study have potential for teaching problem solving techniques to deaf students. Cognitive education is also recommended for deaf students to increase problem-solving skills, which in turn will boost academic success. Systematic cognitive intervention teaches children how to think, not what to think. Some of the thinking skills that may be taught include self-monitoring and problem solving. One way to teach this to students is in the format of steps to follow when faced with a problem. Because of its success, in particular its success with impulsive students, it is recommended for consideration in the curriculum for deaf and hard of hearing students.

In regards to teacher preparation, professional speakers can be invited to the schools. Teachers who are specialists in the area with experience in teaching should be hired and teacher preparation programs should require mathematics education (Pagliaro, 1998; Kluwin & Moores, 1985). Teachers as well as administrators should become more aware of the Standards and collaborate to improve math programs. This perhaps is the most important recommendation—to collaborate and communicate. Communication should be increased: among teachers, between teachers and administrators, and between teachers and scientists.

Educational Product

Increased communication between teachers and researchers is needed. The information from this literature review provides a foundation from which an on-line resource will be created so that the teachers of deaf students in math will have easy access to new findings in this area as well as examples of how to incorporate the findings in their own teaching.

The on-line resource will consist of summaries of research articles, the literature review on problem solving, a section on implications and recommendations for the classroom, and sample lesson plans incorporating the findings in research.

This product will be located in the COMETS Web site, a major information dissemination project funded by the National Science Foundation and based at the National Technical Institute for the Deaf (NTID) at Rochester Institute of

Technology. The website is aimed at providing teachers of deaf students of all ages information on curriculum development and methods in the classroom.

Activities

The following steps will be taken to complete the on-line resource: Research articles related to problem solving will be summarized. The implications and recommendations for future research will be summarized within each article and each will be compiled into its own section as well. Sample lesson plans representing ways in which recommendations from the research can be implemented in the classroom will be written. Other resources that are found during the research process but that do not fit into the aforementioned categories will be organized into a section of "other resources." This may include, but is not limited to web sites, organizations, and other research articles not included in the literature review. A discussion of the whole project will be written as well.

The summaries, lesson plans, implications, recommendations for future research, and other resources will be organized into a usable resource. This resource will then be edited and revised and then posted to the COMETS web page.

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